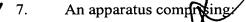
CLAIMS

What is claimed is:

1 1	A411i - i
1 1.	A method comprising

- 2 mounting an integrated circuit on a top surface of a package substrate having
- 3 top and bottom surface buildup layers disposed on a thermally conductive substrate
- 4 core, wherein a portion of the substrate core is exposed at the top surface of the
- 5 package substrate; and
- attaching a heat spreader to the package substrate, the heat spreader thermally
- 7 coupled to the exposed portion of the substrate core and to a backside surface of the
- 8 integrated circuit.
- 1 2. The method of claim 1, wherein attaching the heat spreader comprises soldering
- 2 the heat spreader to the exposed portion of the substrate core.
- 1 3. The method of claim 1 wherein mounting the integrated circuit comprises
- 2 mechanically and electrically coupling the integrated circuit to the top surface of the
- package substrate by a plurality of solder bump interconnections.
- 1 4. The method of claim 1, wherein the exposed portion of the substrate core
- 2 extends around the perimeter of the top surface buildup layers.
- 1 5. The method of claim 1, comprising depositing a thermal interface material
- between the backside surface of the integrated circuit and the bottom surface of the heat
- 3 spreader.
- 1 6. The method of claim 1, comprising attaching a heat sink to a top surface of the
- 2 heat spreader.



Application

- 2 a package substrate having top and bottom surface buildup layers disposed on a
- 3 thermally conductive substrate core, wherein a portion of the substrate core is exposed
- 4 at a top surface of the package substrate to allow for attachment of a heat spreader.

Supra Supra

- 8. The apparatus of claim 7, wherein the exposed portion of the substrate core
- extends around the perimeter of the top surface buildup layers.
 - 9. The apparatus of claim 7, wherein the substrate core is made of metal.

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10. An apparatus comprising

a package substrate having top and bottom surface buildup layers disposed on a thermally conductive substrate core;

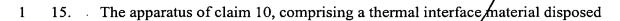
an integrated circuit having a top surface and a backside surface, the integrated circuit mounted on a top surface of the package substrate with the top surface of the integrated circuit facing down; and

- a heat spreader thermally coupled to the substrate core, a bottom surface of the heat spreader thermally coupled to the backside surface of the integrated circuit.
- 1 11. The apparatus of claim 10, wherein the heat spreader is thermally coupled to a
- 2 perimeter portion of the substrate core.

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- 12. The apparatus of claim 10, wherein the heat spreader is soldered to the substrate
- core.
- 1 13. The apparatus of claim/10, wherein the heat spreader is made of metal.
- 1 14. The apparatus of claim 10, wherein the substrate core is made of metal.





- between the backside surface of the integrated circuit and the bottom surface of the heat
- 3 spreader.
- 1 16. The apparatus of claim 10, comprising a heat sink attached to a top surface of
- 2 the heat spreader.
- 1 17. The apparatus of claim 16, comprising/a fan attached to the heat sink.
- 1 18. The apparatus of claim 10, wherein the integrated circuit is mechanically and
- 2 electrically coupled to the package substrate by a plurality of solder bump
- 3 interconnections.
- 1 19. The apparatus of claim 18, comprising a printed circuit board, wherein the
- 2 package substrate is mounted on the printed circuit board.
- 1 20. The apparatus of claim 19, wherein the package substrate is mechanically and
- 2 electrically coupled to the printed circuit board by a plurality of solder bump
- 3 interconnections.

21. An apparatus comprising:

a package substrate having top and bottom surface buildup layers disposed on a thermally conductive substrate core;

at least two integrated circuits having top surfaces and backside surfaces, the integrated circuits mounted on a top surface of the package substrate with the top

6 surfaces of the integrated circuits facing down; and

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- 7 a heat spreader thermally coupled to the substrate core, wherein a bottom
- 8 surface of the heat spreader is thermally coupled to the backside surfaces of the at least
 - -two-integrated-circuits
- 1 22. The apparatus of claim 21, comprising one or more capacitors mounted on a top
- 2 surface of the package substrate.
 - 23. The apparatus of claim 21, wherein the heat spreader is soldered to the substrate
- 2 core.

